R13

Code No: 115DV

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year I Semester Examinations, November - 2015
DESIGN OF MACHINE MEMBERS – I
(Common to ME, AME)

Time: 3 hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART - A (25 Marks)

1.a) What are the factors to be considered for the selection of materials for the design of machine elements? [2]
b) Illustrate how the stress concentration in a component can be reduced. [3]
c) What is an economical joint and where does it find applications? [2]
d) Sketch and discuss the various types of welded joints used in pressure vessels. [3]
e) Distinguish between cotter joint and knuckle joint. [2]
f) What is the effect of keyway cut into the shaft? [3]
g) What type of stresses are induced in shafts? [2]
h) What are flexible couplings and what are their applications? [3]
i) Classify springs according to their shapes. [2]
j) What is nipping in a leaf spring? Discuss its role. [3]

PART - B (50 Marks)
(Assume suitable data if necessary)

2. A mild steel shaft of 50 mm diameter is subjected to a bending moment of 2000 Nm and a torque T. If the yield point of the steel in tension is 200 MPa, find the maximum value of this torque without causing yielding of the shaft according to (a) the maximum principal stress (b) the maximum shear stress and (c) the maximum distortion strain energy theory of yielding. [10]

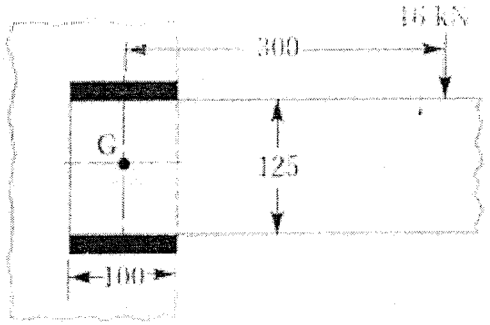
OR

3. A machine component is subjected to a flexural stress which fluctuates between + 300 MN/m^2 and – 150 MN/m^2. Determine the value of minimum ultimate strength according to (a) Gerber relation (b) Modified Goodman relation (c) Soderberg relation. Take yield strength = 0.55 Ultimate strength, endurance strength = 0.5 Ultimate strength and factor of safety = 2. [10]

4. Design the longitudinal joint for a 1.25 m diameter steam boiler to carry a steam pressure of 2.5 N/mm^2. The ultimate strength of the boiler plate may be assumed as 420 MPa, crushing strength as 650 MPa and shear strength as 300 MPa. Take the joint efficiency as 80%. Sketch the joint with all dimensions. Adopt the suitable factor of safety. [10]

OR

5. A 125 × 95 × 10 mm angle is welded to a frame by two 10 mm fillet welds, as shown in Figure. A load of 16 kN is applied normal to the gravity axis at a distance of 300 mm from the centre of gravity of welds. Find the maximum shear stress in the welds, assuming each weld to be 100 mm long and parallel to the axis of the angle. [10]



All dimensions in mm.

6. Design and draw a sleeve and cotter joint to resist a tensile load of 60 kN. All parts of the joint are made of the same material with the following allowable stresses: Tensile stress = 60 MPa, Shear stress = 70 MPa and crushing stress = 125 MPa. [10]

OR

7. Design and draw a knuckle joint to connect two mild steel bars under a tensile load of 25 kN. The allowable stresses are 65 MPa in tension, 50 MPa in shear and 83 MPa in crushing. [10]

8. A steel solid shaft transmitting 15 kW at 200 rpm is supported on two bearings 750 mm apart and has two gears keyed to it. The pinion having 30 teeth of 5 mm module is located 100 mm to the left of the right hand bearing and delivers power horizontally to the right. The gear having 100 teeth of 5 mm module is located 150 mm to the right of the left hand bearing and receives power in a vertical direction from below. Using an allowable stress of 54 MPa in shear, determine the diameter of the shaft. [10]

OR

9. Design and draw a protective type of cast iron flange coupling for a steel shaft transmitting 15 kW at 200 rpm and having an allowable shear stress of 40 MPa. The working stress in the bolts should not exceed 30 MPa. Assume that the same material is used for shaft and key and that the crushing stress is twice the value of its shear stress. The maximum torque is 25% greater than the full load torque. The shear stress for cast iron is 14 MPa. [10]

10. Design a helical spring for a spring loaded safety valve for the following conditions:
Diameter of the valve seat = 65 mm
Operating pressure = 0.7 N/mm^2
Maximum pressure when the valve blows off freely = 0.75 N/mm^2
Maximum lift of the valve when the pressure rises from 0.7 to 0.75 N/mm^2 is 3.5 mm
Maximum allowable stress = 550 MPa
Modulus of rigidity = 84 kN/mm^2
Spring index = 6
Draw a neat sketch of the free spring showing the main dimensions. [10]

OR

11. A helical spring *B* is placed inside the coils of a second helical spring *A*, having the same number of coils and free length. The springs are made of the same material. The composite spring is compressed by an axial load of 2300 N which is shared between them. The mean diameters of the springs *A* and *B* are 100 mm and 70 mm respectively and wire diameters are 13 mm and 8 mm respectively. Find the load taken and the maximum stress in each spring. [10]

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